Draft

March 13, 2008

M E M O R A N D U M

TO: Roger Tinkey, Engineering Manager
Coeur d'Alene Regional Office

FROM: Jennifer Wester, Associate Engineer
Technical Services Division

SUBJECT: Kootenai-Ponderay Sewer District Wastewater Reuse Permit Application Review – LA-000182-02 (Municipal Wastewater)

1.0 Purpose

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.17.400.04 (Wastewater Reclamation and Reuse Regulations) for reuse application permits. It states the principal facts and significant questions considered in preparing the draft permit conditions or intent to deny, and a summary of the basis for approval or denial with references to applicable requirements and supporting materials. This memorandum supplements that dated January 25, 2001.

2.0 Project Description

The Kootenai-Ponderay Sewer District (hereafter KPSD) serves the communities of Kootenai and Ponderay on the north shore of Lake Pend Oreille. The facility is permitted to discharge treated wastewater to Boyer Slough during the non-growing season through its National Pollution Discharge Elimination System (NPDES) permit, ID-002122-9; and is permitted to land apply wastewater during the growing season through its Wastewater Reuse permit, LA-000182-01. No significant changes to the wastewater reuse system have occurred over the last permit cycle. For details of the system, please refer to the memorandum dated January 25, 2001, included in Section 7.1 of the Appendix.

3.0 Summary of Events

The facility initially received a Wastewater Land Application Permit (WLAP) on May 7, 2001 (hereafter 'current permit'). KPSD submitted a re-permit application on February 28, 2007 (hereafter KPSD, 2007b) which was determined substantially complete by DEQ on April 9, 2007.

4.0 Discussion

The following is a discussion of the plan of operation, land application site instrumentation plan, hydraulic management unit (HMU) configuration, constituent loading rates, ground water, and soils. Conclusions and recommendations are provided in Section 5 below.

4.1 Plan of Operation

As a condition of permitting, an updated facility Plan of Operation, also referred to as an Operation and Maintenance (O&M) Manual, will be submitted after permit issuance as an anticipated permit compliance condition. It is understood that a plan of operation is a living document and is modified as operations and regulatory requirements change. Section E, condition CA-182-01, as it appears in the attached draft permit, requires the facility to submit for DEQ review and approval, a plan of operation which includes a Runoff Management Plan for control of possible site runoff; and a Quality Assurance Project Plan (QAPP) for monitoring activities specified in the permit. For the full text of the condition, see Section E of the attached draft permit.

4.2 Land Application Site Instrumentation Plan

KPSD requested (KPSD, 2007b) that a portable tensiometer be included in the draft permit to better ascertain the soil moisture content. There have been times when the moisture probes have indicated wet conditions and the vegetation has shown signs of distress. The current permit does not contain any limits or procedures for soil moisture probes, but there is reference to a Land Application Site Instrumentation Plan (LASIP) that was required as CA-00182-02 of the current permit. As a permit compliance condition of the new draft permit, the facility will update and expand the Land Application Site Instrumentation Plan. Section E, condition CA-182-04, as it appears in the attached draft permit, requests that the facility submit to DEQ for review and approval an updated Land Application Site Instrumentation Plan which includes specifications for all meteorological, soil moisture and groundwater monitoring instruments as well as the operating conditions and procedures for each.

4.3 Hydraulic Management Unit Configuration

No significant changes to the physical arrangement of the land application site have occurred over the last permit cycle. Due to some confusion during the construction process, however, the numbering of the HMUs for the current permit differs somewhat from the layout shown in Appendix 2: Site Map of the current permit. The numbering has again been changed for the draft permit to limit confusion and is shown on the map included in Appendix 2 of the attached draft permit.

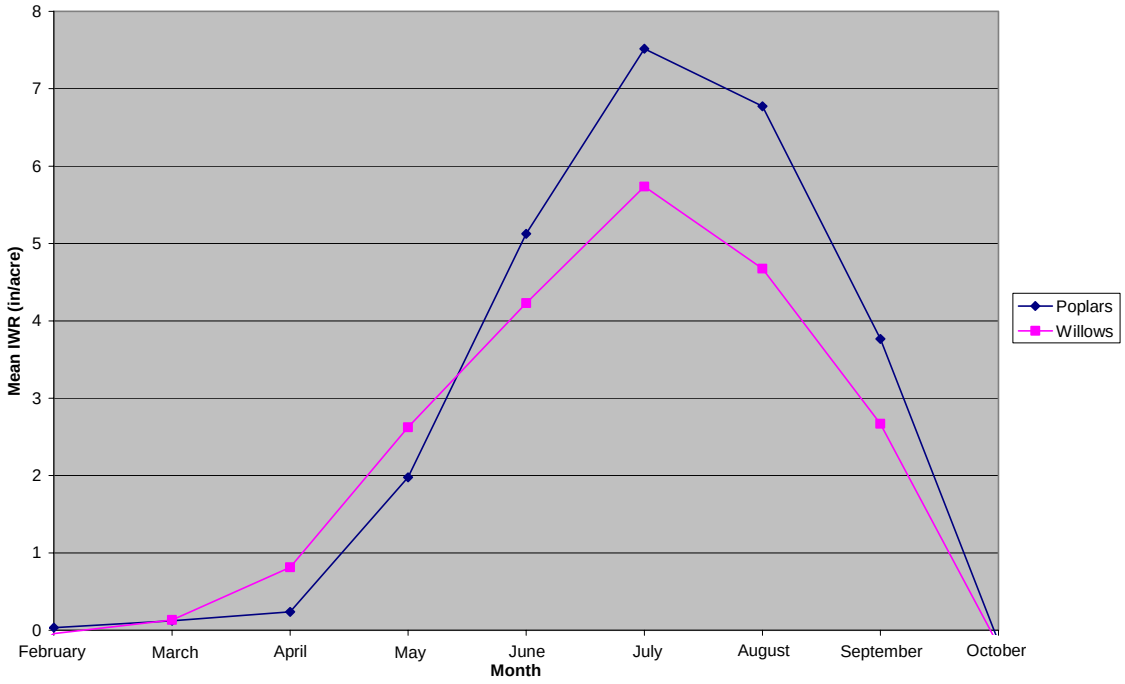
4.4 Constituent Loading Rates

The following section discusses the hydraulic, nitrogen and phosphorus loading rates for inclusion into the draft permit, Section F.

4.4.1 Hydraulic Loading Rates

Over the last permit cycle, the facility has applied between 3.5 MG in 2004 (KPSD, 2005a) and 8.87 MG in 2007 (KPSD, 2007c). The hydraulic loading rate in the current permit is controlled by soil moisture monitoring probes. No changes were proposed by KPSD (KPSD, 2007b) for the hydraulic loading rate, however, the facility is planning to plant willows in those areas where previous plantings of poplars have failed to thrive. As shown in Figure 1, the water requirement of willows at full canopy is much lower than that of poplars for the majority of the growing season.

Figure 1 Irrigation Water Requirement for Poplars and Willows at Full Canopy



It is suggested that a hydraulic loading rate substantially at the IWR (dependant upon stage of tree growth) be applied to each HMU. The following table shows a representative hydraulic load for both tree types by growth year, assuming 85% efficiency for the modified drip irrigation system used by KPSD. Numerical values for the precipitation deficit (irrigation water requirement) for both hybrid poplars and willows were compiled from the website of the University of Idaho extension in Kimberly, Idaho and a weighting factor (USGS, 2001; DEPA, 2003) applied to each to determine the water required by growth year before taking into consideration the irrigation system efficiency (see Appendix 7.2).

Table 1 Irrigation Water Requirements* of Poplars and Willows by Growth Year

(in/acre)	First Year		Second Year		Third Year		Fourth Year +	
	Poplar	Willow	Poplar	Willow	Poplar	Willow	Poplar	Willow
May	1.06	0.86	2.04	1.72	2.31	2.58	3.02	3.44
June	2.76	1.39	5.29	2.77	5.98	4.16	7.82	5.54
July	4.05	1.88	7.76	3.76	8.77	5.64	11.46	7.52
August	3.65	1.53	6.99	3.06	7.90	4.60	10.33	6.13
September	2.03	0.87	3.89	1.75	4.39	2.62	5.75	3.50
October**	0.36	0.21	0.70	0.43	0.79	0.64	1.03	0.86
Total	**13.91**	**6.75**	**26.66**	**13.50**	**30.13**	**20.24**	**39.40**	**26.99**

*Based on ET data from http://www.kimberly.uidaho.edu/ETIdaho/stninfo.php?station=108137 for poplars and willows, a growth related irrigation requirement weighting factor and 85% irrigation efficiency.
**October values based on sum of average rainfall per day (0.05 in/day) and October IWR for poplars and willows.

The operator and site manager have requested that the growing season be extended into October. The IWR numbers from the website that were used to build Table 1 for both hybrid poplars and willows are statistically negative for the month of October. However, in some years irrigation may be required to supplement low rainfall totals during the month of October. An average rainfall value of 0.05 inches/day was assumed for the first fifteen (15) days of October and added to the IWR values from the website. Since this facility relies on soil moisture monitoring probes to determine irrigation times and durations, it is proposed that the facility be permitted to irrigate during the first fifteen (15) days of October up to the value in Table 1 in accordance with the moisture monitors and visible crop stress (i.e., leaf wilting). In addition, it is proposed that the facility only irrigate on days when the air temperature is above 50ºF and no standing water is left to freeze overnight.

4.4.2 Nitrogen Loading Rate

It is proposed that the list of monitored parameters for the wastewater sample analyses be modified to include the following: Nitrate-Nitrogen, Nitrite-Nitrogen, Total Kjeldahl Nitrogen (TKN), total Phosphorus, and Chemical Oxygen Demand (COD). Total Nitrogen is defined as the sum of the nitrate-nitrogen, nitrite-nitrogen and TKN. This combined value is more indicative of the concentration of nitrogen available to the trees from the applied wastewater; therefore it is recommended that nitrite-nitrogen be added to the analytes list.

Nitrogen loading values for KPSD have ranged from 7.9 lbs/acre (KPSD, 2005a) to 126.7 lbs/acre (KPSD, 2007c). Nitrogen uptake values for hybrid poplars and willows seem to be around 300 lbs/acre and 170 lbs/acre, respectively. Since the facility is growing predominantly poplar trees with some willows mixed in, a nitrogen loading limit of 250 lbs/acre is proposed in the draft permit.

4.4.3 Phosphorus Loading Rate

Currently, there is no phosphorus (P) loading limit included in the draft permit as phosphorus loading rates are generally set by DEQ based upon either ground water or surface water concerns. With respect to ground water concerns, DEQ does not usually set a phosphorus

loading limit where there is no ground water/surface water interconnection (i.e. where ground water discharging from the down-gradient boundary of the treatment site does not enter surface water). While there is one seasonal tributary which is located immediately to the northeast of the facility, it is a losing stream which likely contributes seepage to ground water. Also, the facility applies P at relatively low rates of between 2.2 lbs/acre (KPSD, 2005a) and 31.1 lbs/acre (KPSD, 2007c). Wastewater is not applied during precipitation events as a means to minimize runoff (and potentially phosphorus-bearing sediment runoff); phosphorus contamination in the receiving water (Boyer Slough and ultimately, Lake Pend Oreille) should not become a concern during the new permit cycle. In addition, a runoff control plan is included as a compliance activity in Section E, CA-182-05 of the draft permit As a consequence, no numerical phosphorus loading limit is proposed in the draft permit.

4.4.4 Chemical Oxygen Demand Loading Rate

Currently, there is no Chemical Oxygen Demand (COD) loading limit included in the draft permit. The facility has historically applied COD at low rates between 0.9 lb/acre-day (KPSD, 2005a) and 2.4 lb/acre-day (KPSD, 2007c). The *Guidance* (DEQ, 2007) recommends that the yearly average loading rate for COD not exceed 50 lb/acre-year. Based on past trends, the facility is not likely to approach the guidance limit during the next permit cycle; therefore no numerical loading limit is proposed for COD. It is proposed that COD continue to be sampled once per year in August as an average value for the season.

4.5 Ground Water

There are three ground water monitoring wells at the land application site. The current permit requires sampling of all three wells in May and August for nitrate, chloride, total coliform and TDS. Data from late 2003 through 2007 show a large amount of variability in the values of the requested parameters. As shown in Tables 2 through 4, nitrate-nitrogen has generally not been detected in any of the three monitoring wells. Chloride results have varied from less than 0.5 mg/L in the South well (KPSD, 2004 and 2005b) to 15 mg/L in the Middle well (KPSD, 2007c). Total Dissolved Solids (TDS) results have generally been from 113 mg/L in the South well (KPSD, 2007c) to 368 mg/L in the North well (KPSD, 2007c). Intra-well comparison of total coliform results in all wells show that levels vary widely, from less than 2 CFU/ 100 mL in July 2005 to greater than 2419 CFU/ 100 mL in 2004 (KPSD, 2005a). Inter-well comparison of total coliform data show a similar pattern of high May 2004 levels, lower and ND levels in Spring/Summer 2005, elevated levels in late summer 2006, and lower and ND levels again in Spring/Summer 2007. It may be that these similar inter-well patterns are partly due to sampling and decontamination conditions, and/or laboratory or analytical factors. There does not seem to be any correlation between well position (up or down gradient) and coliform counts. It is unlikely that coliform in wells represents human enteric species land applied in wastewater, but rather ubiquitous soil coliforms or from other non-enteric sources. To determine possible sources of coliforms detected, speciation of coliforms would need to be done, which is not proposed at this time.

Table 2 KPSD Groundwater Monitoring Data 2003 – 2006, North Well; GW-0182-01

Year	2003	2004	2005		2006	2007	
Sample Date	6/19/2003	5/12/2004	5/11/2005	7/15/2005	8/8/2006	5/21/2007	7/10/2007
Nitrate-N (mg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride (mg/L)	0.6	0.8	0.2	1.0	0.5	0.6	13
TDS (mg/L)	330	320	313	366	350	321	368
Total Coliform (cfu/100 mL)	---	**>2419**	**63**	<2	**1986**	80	<2

--- 2003 sample not analyzed for total coliform
Bolded values in excess of Ground Water Quality Standard (IDAPA 58.01.11)

Table 3 KPSD Groundwater Monitoring Data 2003 – 2006, Middle Well; GW-0182-02

Year	2003	2004	2005		2006	2007	
Sample Date	6/19/2003	5/12/2004	5/11/2005	7/15/2005	8/8/2006	5/21/2007	7/10/2007
Nitrate-N (mg/L)	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride (mg/L)	0.9	2.0	5.2	5.2	8.9	15	13
TDS (mg/L)	280	300	297	300	270	288	275
Total Coliform (cfu/100 mL)	---	**>2419**	**15**	<2	**1046**	**>1600**	**170**

--- 2003 sample not analyzed for total coliform
Bolded values in excess of Ground Water Quality Standard (IDAPA 58.01.11)

Table 4 KPSD Groundwater Monitoring Data 2003 - 2006, South Well; GW-0182-03

Year	2003	2004	2005		2006	2007	
Sample Date	6/19/2003	5/12/2004	5/11/2005	7/15/2005	8/8/2006	5/21/2007	7/10/2007
Nitrate-N (mg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride (mg/L)	<0.5	<0.5	<0.2	2.4	0.7	<0.5	<0.5
TDS (mg/L)	170	120	116	154	170	113	123
Total Coliform (cfu/100 mL)	---	**>2419**	**65**	<2	**159**	**7**	<2

--- 2003 sample not analyzed for total coliform
Bolded values in excess of Ground Water Quality Standard (IDAPA 58.01.11)

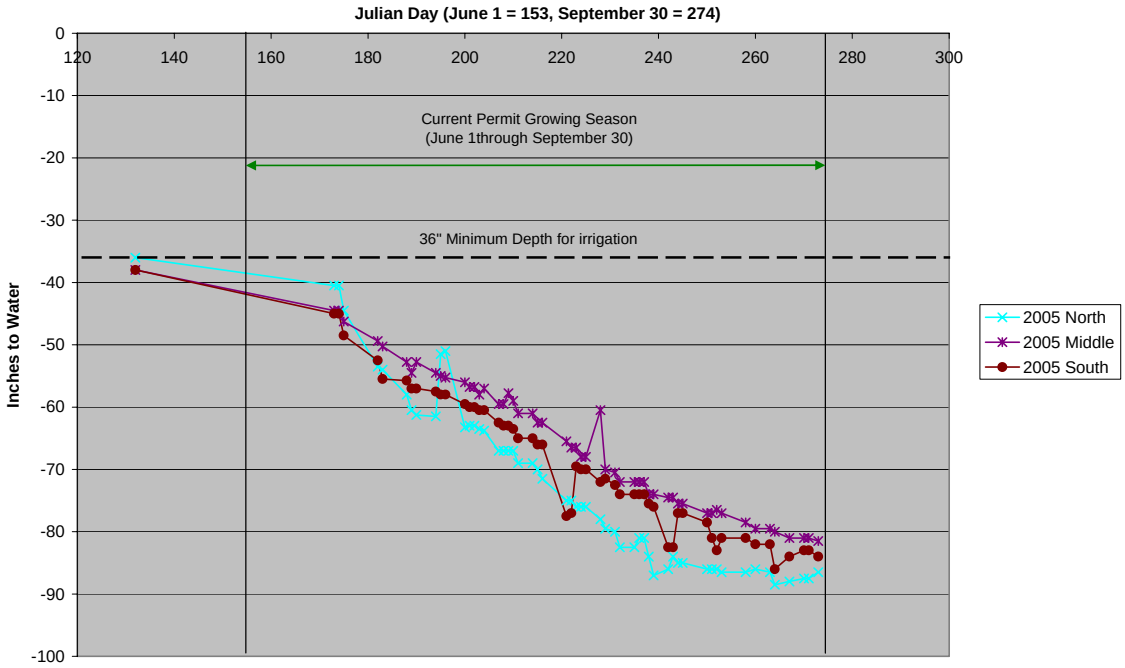
The current Groundwater Quality Rule (IDAPA 58.11) establishes a limit of 1 CFU/100 mL for total coliform. In speaking with Tim Closson, the operator (Closson, 2007), it was noted that in the past, horses have been pastured in the northern portion of the facility's acreage, though not within the fenced site, and may have been there as recently as two years ago. May sampling was overlooked in 2006, but it was suggested by the operator that the 2005 samples may have been impacted by these activities. It is recommended that sampling of the groundwater monitoring wells for nitrate-N, chloride, total coliform and TDS be discontinued. All three monitoring wells are shallow, tapping into an aquifer that is only seven feet under the surface and not beneficially used. Primary concern for this site is that the depth to groundwater is no less than thirty-six inches.

The facility has stated in various annual reports (KPSD, 2004 and 2007a) that the monitoring wells were often dry or purged dry during the August sampling event. In 2005 and 2007, KPSD performed the fall sampling in mid-July and reported sufficient water to sample according to the permit procedures. The results for the July 2005 sampling event and the July 2007 North and South well samples are consistently lower than those reported for August 2006, especially for coliform. In the narrative for the 2006 Annual Report, the facility stated that "the August

sampling as required by the permit was performed. However, there was only enough water to purge less than one casing volume instead of three as required. Samples were taken anyway, although sample results may not be representative because of insufficient ground water."

The current permit requires that depth to groundwater be measured daily to ensure that a minimum depth of thirty-six (36) inches is maintained when irrigating. Figure 2 shows the trend in monitored depth to groundwater in all three wells during the 2005 operating season. As shown, during the bulk of the permitted growing season, depth to groundwater is greater than thirty-six (36) inches; therefore staff recommends that daily measurement of groundwater be discontinued for most of the growing season. Since groundwater appears to be low enough during the month of May, staff recommends extending the permitted growing season in the draft permit from May 1st to October 15th, with depth to groundwater measured only during the first and last months of irrigation (usually May and September/October), to determine the start and end of the irrigation season.

Figure 2 KPSD Depth to Groundwater Measurements 2005



4.6 Soils

Under the current permit, soil sampling was performed in June 2003, prior to application of wastewater, and again in October 2006. These results are summarized in the following tables for Fields 3 and 5 (formerly fields 5 and 14, respectively), which were selected to fulfill Monitoring Requirement 6 of the current permit, which specifies that "soil monitoring be done from two (2) selected fields."

Table 5 Soil Sample Data for Field 3 (MU-018203)

Depth	0" – 12"	12" – 24"	0" – 12"	12" – 24"
Date	5/19/2003	Not Sampled	10/12/2006	10/12/2006
Ammonia-N (mg/kg)	2.6		<0.300	<0.300
Cation Exchange Capacity (CEC) (meq/100 g)	24.5		16.3	13.6
Conductivity	76.7 (µS/cm3)		592 (umhos/cm)	361 (umhos/cm)
Nitrate-N (mg/kg)	17.2		32.2	17.2
Phosphorus (mg/kg)	2.71		8.20	3.40

Table 6 Soil Sample Data for Field 5 (MU-018205)

Depth	0" – 12"	12" – 24"	0" – 12"	12" – 24"
Date	5/19/2003	Not Sampled	10/12/2006	10/12/2006
Ammonia-N (mg/kg)	2.1		<0.300	<0.300
Cation Exchange Capacity (CEC) (meq/100 g)	25.7		14.9	12.2
Conductivity	79.3 (µS/cm3)		893 (umhos/cm)	974 (umhos/cm)
Nitrate-N (mg/kg)	14.2		24.9	23.6
Phosphorus (mg/kg)	2.08		4.90	5.20

KPSD did not propose any changes to the soil monitoring criteria. Staff suggests continuing to monitor for nitrate-nitrogen, ammonia-nitrogen, and plant available phosphorus. Specific conductivity and cation exchange capacity (CEC) are not expected to change appreciably over the next permit cycle. The methods previously used for analysis of each sample set are different therefore no data trending can be done to show that application of wastewater to the site has not impacted the soil characteristics. Staff recommends annual sampling in the spring for the next permit cycle, using the same analytical methods, as approved by DEQ, at each sampling event, to show the impact of wastewater irrigation and beneficial reuse of nutrients at the site. Staff also recommends that the facility use a laboratory that participates in a proficiency testing program.

5.0 Conclusion

The following recommendations fall into three major areas. They include loading rate related recommendations, ground water and soil related recommendations, and other recommendations.

5.1 Loading Rate Related Recommendations

1) It is recommended that nitrite-nitrogen be added to the wastewater sampling analytes list as discussed in Section 4.4.2.

2) Since the facility will be growing different crops (poplars and willows), it is recommended that the growing season hydraulic loading limit be included, as discussed in Section 4.4.1.

5.2 Ground Water and Soil Related Recommendations

1) It is recommended that sampling of the groundwater monitoring wells for nitrate-N, chloride, total coliform and TDS be discontinued, as discussed in Section 4.5.

2) It is recommended that soil sampling be conducted annually each spring of the next permit cycle. Modification of the analytes list is proposed, as discussed in Section 4.6, in order to sample parameters that are indicative of soil and crop uptake characteristics and allow comparison of future results to historical data.

3) Due to crop water requirements, it is recommended that the permitted growing season be extended from May 1 to October 15, with depth to groundwater measurements taken during May and October, as discussed in Section 4.5.

5.3 Other Recommendations

1) The current version of the Land Application Site Instrumentation Plan (LASIP) does not contain any limits or procedures for the soil moisture probes, therefore it is recommended, as discussed in Section 4.2, that the facility revises the LASIP to include these items for current as well as any proposed additional instrumentation.

6.0 References Cited

Closson, 2007. Personal communication with Tim Closson. Spring 2007.

DEPA, 2003. Danish Environmental Protection Agency. 2003. *Short-rotation Willow Biomass Plantations Irrigated and Fertilised with Wastewaters: Results from a 4-year multidisciplinary field project in Sweden, France, Northern Ireland and Greece.*

DEQ, 2007. Idaho Department of Environmental Quality. September 2007. *Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater*.

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KPSD, 2005a. Kootenai-Ponderay Sewer District. 14 January, 2005. [2004] Annual Report for WW Land Application Site.

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KPSD, 2007b. Kootenai-Ponderay Sewer District. 26 February, 2007. KPSD Permit No. LA-000182-01 Renewal Application.

KPSD, 2007c. Kootenai-Ponderay Sewer District. 13 December, 2007. 2007 Wastewater Land Application Annual Report, Permit #182-01.

USDA, 2001. Loren St. John, Aberdeen PMC Manager, USDA-NRCS. January 2001. TN Plant Materials No. 37 Hybrid Poplar: An Alternative Crop for the Intermountain West.

cc: WLAP Source File no. LA-000182-02 (SO & CRO)
John Tindall, CRO
Michael Spomer, SO
Richard Huddleston, SO

7.0 Appendix

7.1 January 25, 2001 Memorandum

January 25, 2001

M E M O R A N D U M

TO: Rick Huddleston, P.E., Manager
State Office, Boise

FROM: John Tindall, P.E., Staff Engineer
Coeur d'Alene Regional Office

SUBJECT: **Staff Analysis of the Kootenai-Ponderay Sewer District Wastewater Land Application Permit, LA-000182-01 (Municipal Wastewater)**

Summary

The Kootenai-Ponderay Sewer District serves the cities of Kootenai and Ponderay along the north side of Lake Pend Oreille. Most of the District lies on the north and south side of Hwy. 200 about 4 miles northeast of Sandpoint. The District owns and operates the wastewater collection system and treatment facility. The treatment system consists of lagoons with sand filters followed by disinfection and discharge (as allowed by the District's NPDES Permit) into Boyer Slough which enters Lake Pend Oreille. The District collects and treats about 96 million gallons of wastewater annually which currently is all discharged to Boyer Slough. The District has purchased 136 acres about 1 mile northwest from the existing lagoons. The District is proposing to seasonally use the land application site to reduce or eliminate the discharge of effluent to Boyer Slough during the "growing season". The land application site will be planted with poplar trees. Staff recommends issuing a permit for this new site in accordance with this staff analysis.

Purpose

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.17400,04 (Wastewater-Land Application Permit Regulations) for issuing land application permits. It states the principal facts and significant questions considered in preparing the draft permit conditions or the intent to deny, with a summary of the basis

for the draft conditions or denial with references to applicable requirements and supporting materials.

General Background

The Kootenai-Ponderay Sewer District (District) serves the communities of Kootenai and Ponderay along the north side of Lake Pend Oreille. The District serves 954 Equivalent Residences, which are a combination of residential and commercial accounts. The current annual wastewater flow is about 96 million gallons. The existing treatment plant consists of an aerated lagoon, storage lagoon, chlorine contact chamber and sand filters with a discharge to Boyer Slough which enters Lake Pend Oreille. For the discharge into Boyer Slough, the District has an NPDES (Permit No. ID-002122-9) issued by EPA which expired September 25, 1989. EPA has not reissued the permit and the District is able to comply with the permit limits of this expired permit. EPA may have a new NPDES permit issued by June 2001. Both raw sewage and septic tank effluent are treated. The wastewater collection system consists of a combination of gravity lines and force mains with pump stations.

The District proposes to continue using the existing wastewater treatment/disposal facility from October through May. From June through September, the wastewater would be land applied. This will eliminate the discharge to Boyer Slough during the "growing season". Nutrients and oxygen demanding material found in the wastewater effluent will not be discharged during the growing season and will likely improve the water quality in Boyer Slough and Pend Oreille Lake.
The report titled "Clark Fork/Pend Oreille Sub-Basin Assessment and Total Maximum Daily Loads" dated 4/17/00 includes no specific recommendations on future limits which will be applied for the discharge of treated wastewater from the Kootenai-Ponderay Sewer District WWTP to Boyer Slough. The District has taken the initiative to pursue the land application option as a means to meet potential more stringent discharge requirements and allow for anticipated growth in the area. This strategy would not eliminate the pollutants being discharged into Boyer Slough but would reduce the impacts from the nutrient discharge by not discharging during the growing season. It is not possible to predict exactly how the use of land application will impact future NPDES permit limits.

Proposed Land Application Site: Soils, Climate, Growing Season and Crops

The proposed land application site is on 136 acres that is currently being used to grow hay. As shown on the U.S.G.S. quadrangle map, the proposed site is about 1 mile northeast from the existing wastewater treatment plant. In general, the site is bordered as follows: on the north by Whites Rabbit Ranch Road and prescriptive right-of-way; on the east by Providence Road; on the west by the Union Pacific Railroad (Spokane International) and private 5 acre land holdings; and on the south by private farm property. The site gently slopes to the south where there is a surface drain. The eastern and northwestern borders are treed with cottonwoods, poplars and pine

creating good buffers. The northwestern border also parallels the Union Pacific Railroad track. The southwestern border adjoins with 5 acre parcels with residential homes.

Pend Oreille Lake is located about 1.5 miles to the south from the land application site. There is a drainage ditch along the south edge of the property that has seasonal flow.

Soils: From a geotechnical report (Terracon, 1998), the soils on this site consist of topsoil (0.5' - 1.5') followed by an upper clay layer (1.5' - 3' thick), sand (2' - 3.6' thick) and a lower clay layer starting from 4.5' - 6.5' below the existing ground surface and continuing to the bottom of all the test pits at about 9.5' below the surface. The depth to groundwater found when the test pits were dug on 8/6/98 was 7.2' to 7.5' below the surface in three of the six test pits.
The only well log submitted (for the Degan's well located near the southeast corner of the site) did not include any details on the lithology. The thickness of the lower clay layer has not been presented.

Percolation testing was not performed by the geotechnical firm but the Soil Survey of Bonner County, Idaho, 1982 (Soil Conservation Service), lists the permeability as <0.06 to 2 inches per hour. Based on the Soil Survey, the predominant soil type on the site is #32, Mission Silt Loam. Some of the applicable general characteristics of this soil include the following: Available Water Capacity 0.07-2.0 in./in.; high water table within 0.5'-1.5' of the surface(perched) February to May; "Hydrologic Group 'D'" with slow infiltration rate and high runoff potential. The geotechnical report does not make any recommendations regarding the suitability of the site for wastewater land application.

Due to the potential high water table into May, the land application period should start June 1.

Climate: This site is in eastern Bonner County at elevation 2,130. Mean annual air temperature is 46 degrees Fahrenheit. Average annual precipitation is about 33 inches, and average annual evaporation is about 30 inches; in the months May through September, the average monthly evaporation exceeds the average monthly precipitation. The climate is suitable for forests.

Growing Season and Crops: The closest associated crop to a natural forest is "fruit trees with cover". In the South Bonner County area, a "fruit trees with cover" crop has an evapotranspiration rate (consumptive use) of 33.78 inches and a 167 day growing season, from May 1 through October 15. Average precipitation exceeds average evaporation in October and wastewater should not be applied during this month which reduces the net consumptive use to 32.33 inches. Staff agrees with the annual application rate proposed in the WLAP application of 20 inches for the first three years as an estimate of the volume that can be applied to the poplars. Using the consumptive use rates for June to September (28.65 inches) and the precipitation (6.5 inches),

amount which could be applied to "fruit trees with cover" is 22.2 inches (28.65 - 6.5 inches).

Staff Recommended Draft Permit Conditions
1. Wastewater application only during the five-month growing season from June 1 through September 30.

Wastewater Quantity and Quality

The District's current total annual wastewater flow is approximately 96 million gallons (MG). The District's consultant estimates a 20-year design annual wastewater flow to be about 139 MG. The land application system would be designed to allow the District to maintain an annual discharge of 76.4 million gallons to Boyer Slough over the 20-year design period. This would allow for growth while mitigating the impact of the wastewater discharge into Boyer Slough and Pend Oreille Lake.

Initially, using a projected annual application rate of 20 inches, 40 acres of land application area will be required. At the projected 20-year design flow and maintaining the annual discharge of 76.4 million gallons, the annual application would increase to 40 inches and the land application area would increase to 60 acres. The soil moisture probes will be used to determine the actual application rates which will assure that enough water is provided for the trees without over applying. Poplars can annually require up to 50-60 inches of water. At this time, staff accepts the District's initial design values for the application rates.

The annual loading to the land application site based in the maximum proposed annual wastewater application rate (40 inches) is also provided in Table 1. Staff accepts the constituent values proposed by the applicant, and staff finds the annual constituent loading well below guideline values. The land-limiting factor for this facility is wastewater volume. Soil infiltration capacity and seasonal high groundwater will also limit the wastewater volume that can be applied.

Table 1
Kootenai-Ponderay Sewer District
Estimated Lagoon Effluent Wastewater Quality

constituent	concentration	annual loading (40 inches)
total nitrogen	20 mg/l	181 lbs/acre
total phosphorus	6.5 mg/l	58.8 lbs/acre
BOD	30 mg/l	272 lbs/acre

Wastewater Process Description

During the non-growing season (October 1 to May 30), wastewater will be treated and discharged to Boyer Slough in compliance with the District's NPDES Permit. Lagoon storage requirements for the existing population as proposed by the District's consultant in the land application permit report will be 1.61 MG. The District's consultant states that a 6 MG lagoon should initially be built on the site which can be expanded to 28 MG to accommodate the 20-year design population. The lagoon would be lined with a 60-mil HDPE liner. "Recommended Standards for Wastewater Facilities, 1997" recommends that at least a four (4) foot separation be maintained between the maximum ground water level and a lagoon bottom. It is not clear how the District plans on handling this constraint. This issue will be pointed out to the District and consultant.

The District's goal is to maintain the annual discharge to Boyer Slough at 76.4 MG with the remaining flow going to the land application system. The lagoon will take up about 10 acres of the site. The lagoon will be drawn down and emptied during the growing season. A gas chlorination system is currently used for disinfection at the existing wastewater treatment site. Additional chlorine contact time will be designed into the 6 MG storage lagoon/irrigation system to meet the total coliform limits in the land application permit. The type of chlorine disinfection system (gas or liquid) has not been specified. The initial land application area required will be 40 acres and the 20-year design flow will require 60 acres. The site as proposed in the application is divided into 14 fields with each field being between 3.5 - 10 acres for a total of 75 acres.

Land Application Analysis

Staff has analyzed the District's wastewater land application proposal and the following conclusions will apply as follows:

- The proposed site has soils and a proposed crop (poplar trees) suitable for wastewater land application. If the District is not successful in establishing a viable crop of poplars, the site could be used for hay production as it currently is but the hydraulic loading rates will be reduced to about 20 inches/year.
- The proposed land application site acreages (40 acres initially and 60 acres for 20-year flows) appear to be reasonable estimates for handling the 20-year design flow of 85 MG to be land applied at a theoretical maximum hydraulic application rate of 40 inches/year based on the literature recommendations for poplars.
- The actual operational hydraulic loading rates for the site will be based the daily soil moisture readings taken from each of the 14 fields. A threshold for hydraulic application rates will be established by the District and approved by DEQ in a "Land Application Site Instrumentation Plan". A strategy will be developed to assure that the poplars have adequate moisture (from natural

sources and from wastewater application) without allowing an over application of wastewater. With the clay soils and the seasonal high groundwater, the poplars will have an available water supply for much of the year. The wastewater will supplement this natural supply. The poplars ability to utilize the natural water supply and the wastewater can best be determined by monitoring soil moisture. Soil moisture readings may be tied to "available water capacity" to optimize the wastewater application given the type of soil found at the site.

- At the 20-year design flow hydraulic application rate, the annual wastewater constituent loadings for total nitrogen (181 lbs./acre/year) is less than estimated annual nitrogen uptake for poplars (264-352 lbs./acre/year). The design flow BOD loading rate (272 lbs./acre/year) also should not cause any impacts.
- Wastewater volume (hydraulic application rate) is the limiting factor for the proposed land application site based on applying at the theoretical crop needs. Theoretical nutrient requirements will not be met by the wastewater applied at the maximum estimated hydraulic loading rate.

Impacts to Ground Water

There is an upper ground water layer in this area which is relatively shallow. During the examination of the test pits on August 6, 1998 by the geotechnical consultant, free water was reported in three of the six test pits at depths ranging from 7.2 to 7.5 feet below the surface. The geotechnical report notes that two clay layers were found in the test pits which were dug to a depth of about 9.5 feet below the surface. The lower clay layer extended down past the depth of the test pits. The free water found in the test pits may be the perched water table caused by the lower clay layer. The only well log submitted (for the Degan's well located near the southeast corner of the site) shows that the static water level was found at 50', the total well depth is 754' and the production is 2 gpm.

In the Soil Survey of Bonner County, Idaho, 1982 (Soil Conservation Service), the predominant soil on the site is listed as a Mission Silt Loam. This type of soil is listed as having a perched water table between 0.5 to 1.5 feet below the surface from February to May.

The synthetically lined lagoon at the proposed land application site should eliminate any impacts from the storage of wastewater to ground water. As previously mentioned, "Recommended Standards for Wastewater Facilities, 1997" recommends that at least a four (4) foot separation be maintained between the maximum ground water level and a lagoon bottom. It is not clear how the District plans on handling this constraint.

The constituent loadings to the proposed site are well below guideline values. There is some potential for impacts to groundwater from the wastewater application due to the ground water and soil conditions. There is also uncertainty regarding whether the poplars will draw the majority of water from the shallow groundwater or from the upper

soil where the wastewater is applied. Therefore soil moisture probes and shallow groundwater monitoring wells will be required to examine this feature. The data gathered from the wells will be used to determine if any impact is occurring from the application on this site.

Management of the wastewater application rates should be similar to the approach used for the Hayden Area Regional Sewer Board (HARSB, LA-000109-02) land application system. Each field used for land application should have soil moisture probes installed. The District will submit a "Land Application Site Instrumentation Plan" which will describe the method for controlling the hydraulic loading rates such that leaching of excess wastewater past the root zone will be minimized. The plan will describe the instrumentation system to be used to monitor soil moisture, precipitation and temperature as well as how the upper ground water will be monitored and sampled. The District will probably need to hire a consultant with expertise in irrigation instrumentation and the specific irrigation requirements of poplars. The submittal of this plan will be a "compliance activity" in the permit. The goal will be to develop an operational strategy similar to that used where water conservation requirements dictate the need to apply only what the trees require.

The use of lysimeters for sampling the soil water was also considered but it did not seem necessary on this site. The shallow ground water table should provide adequate opportunities to monitor the impacts from wastewater not being utilized by the crop.

Ground water monitoring wells are proposed by the District to be installed in three (3) representative locations. One upgradient well and two downgradient wells will be adequate with all constructed to monitor the upper ground water layer. Daily static water level depths will be taken from each well during the irrigation season and the ground water will need to be at least three (3) feet below the surface before wastewater irrigation can occur. Sampling for nitrate-N, chlorides, total coliforms and total dissolved solids (TDS) will be required twice each year (once in May and once in August) from each well. Monitoring once in the non-irrigation season will provide annual background levels and changes during the irrigation season can be more easily detected.

Ground Water Quality Rule (IDAPA 58.01.11)

The ground water underlying the proposed application site is used on a limited basis as a drinking water source due to the great depth of a good water source and the low yield. The Oden Water System supplies water to many of the homes around the site and they use surface water for the water supply due to the ground water conditions. There is an upper aquifer which does not provide a reliable source and the lower aquifer produces low yields. As defined in the Idaho "Ground Water Quality Rule", this aquifer would be considered a "General Resource" aquifer and the level of protection required is to apply "best management practices and best practical methods" for any activity which may degrade the water quality (see Section 150.02, Table I in the Ground Water Quality Rule, IDAPA 58.01.11).

Management of the proposed land application site to limit any leaching of applied wastewater past the root zone is considered a “best management practice and best practical method”. The leaching potential will be controlled by the use of soil moisture probes as previously explained. In addition, ground water will be sampled to check on the impacts from the wastewater application.

The “1988 WLAP Guidelines” establish buffers of 500 and 1000 feet for the distances from the land application site and private and public drinking water wells, respectively. There are no known drinking water wells within these guideline criteria setbacks. Considering the thickness of the lower clay layer found during the geotechnical investigation (extending past the maximum depth of the test holes at 9.5') and the depth of the nearby drinking water wells (754' for the Degan well) combined with management of the application rates using soil moisture probes, the potential for impacting any of the wells in the area is minimal.

Staff Recommended Draft Permit Condition

3. No later than three months prior to starting irrigation, the permittee shall submit a “Land Application Site Instrumentation Plan” to the Department for review and approval that incorporates the use of the following:
   a) daily precipitation and temperature instruments;
   b) soil moisture instruments; and
   c) upper ground water layer monitoring.

   Prior to starting irrigation, the permittee shall install all instrumentation required in the approved “Land Application Site Instrumentation Plan”.
4. The “Land Application Site Instrumentation Plan” will describe the method for controlling the hydraulic loading rates such that leaching of excess wastewater past the root zone will be minimized. All aspects of the soil moisture monitoring strategy will need to be presented including, but not limited to, the types of soil moisture probes, the depth of the probes, the location of the probes in the fields, the basis for selection of a maximum soil moisture threshold, annual equipment costs, O&M considerations and the method of collecting data.
5. The precipitation and temperature measurement instruments shall be installed on the land site and shall be monitored and recorded daily during the application season.
6. Ground water monitoring wells will be installed in three (3) representative locations. One upgradient well and two downgradient wells will be adequate with all constructed to

Staff Recommended Draft Permit Condition
monitor the upper ground water layer. Daily static water level depths will be taken from each well during the irrigation season and the ground water will need to be at least three (3) feet below the surface before wastewater irrigation can occur. Sampling for nitrate-N, chlorides, total coliforms and total dissolved solids (TDS) will be required twice each year (once in May and once in August) from each well. Monitoring once in the non-irrigation season will provide annual background levels and changes during the irrigation season can be more easily detected.

Buffer Zones, Fences and Signs

The District is proposing to meet the secondary, disinfected 23 total coliform organisms/100 ml limit. The proposed new site meets guideline buffer zones for secondary disinfection (23 total coliform organisms/100 ml), and staff recommends guideline buffer zone distances for "suburban/residential areas - sprinkler irrigated" in the draft permit.

The "1988 WLAP Guidelines" establish buffers of 500 and 1000 feet for the distances from the land application site and private and public drinking water wells, respectively. Some of the land owners surrounding the site are connected to the Oden Water System which is a public system with a surface water source. For the properties adjacent to the proposed site, the District's application includes a map showing the lots with residences, known wells and the source of water for most of the lots.

Staff Recommended Draft Permit Conditions
7. The wastewater disinfection level shall be secondary disinfection (23 total coliform organisms/100 ml). 8. The draft permit shall include guideline buffer zone distances, as follows: 300 feet between site and inhabited dwellings; 50 feet between site and areas accessible to the public; 500 feet and 1000 feet between the site and private and public wells, respectively. 9. The fencing and sign requirements shall be as described in the guidance for the proposed disinfection level and a "suburban and residential" location, as follows: woven pasture fence around the site; posting with signs reading "Irrigated with Reclaimed Wastewater- Do Not Drink" or equivalent every 500 feet and at each corner of the outer perimeter of the buffer zones.

Sampling and Monitoring

Staff proposes sampling and monitoring requirements as follows:

Wastewater: Staff recommends during irrigation periods: daily volume transferred to the storage lagoon, volume applied to each field and chlorine residual readings; weekly testing for total coliform bacteria from a sample tap on the irrigation system; and once every August testing for nitrate-N, TKN, phosphorous, COD and TDS.
Soil moisture: Staff recommends during irrigation periods: daily soil moisture readings.
Ground water: Staff recommends: sampling of the groundwater monitoring wells once in August and once in May for nitrate-N, total coliform, TDS and chlorides.
Crop: Since the crop is a poplar plantation, annual crop sampling is unnecessary. However, the permittee must prepare and implement a silvicultural plan for replanting and harvesting.
Supplemental irrigation: If supplemental irrigation is employed, monthly flows to each hydraulic management unit (HMU) must be recorded.
Soils: Initial background sampling, then sampling every three years for nitrate-N, ammonium-N, plant available phosphorous, specific conductivity and cation exchange capacity.

Staff Recommended Draft Permit Condition
10. The draft permit shall include the sampling and monitoring provisions as described in this section.

Conditional Use Permit

The District has received a "Conditional Use Permit" from Bonner County in August 2000 to develop the site for wastewater land application.

Reviews

This staff analysis and accompanying draft permit were reviewed by the Coeur d'Alene regional office staff and their comments have been incorporated.

Recommendations for the Draft Permit

Recommendations for the draft permit are contained with the text boxes within this staff analysis. Staff recommends land application of wastewater be permitted contingent upon the recommendations in this staff analysis.

7.2 IWR Formulation Methodology

The IWR values for KPSD (Table 1) were derived from precipitation deficit (P_{def}) data available for hybrid poplars and willows from the ET_{Idaho} Sandpoint KSPT station (http://www.kimberly.uidaho.edu/ETIdaho/stninfo.php?station=108137). Table 7 shows the data taken from the ET_{Idaho} website for both tree species.

Table 7 Precipitation Deficit (P_{def}) Data

	Poplars		Willows	
	mm/day	**in/month***	**mm/day**	**in/month***
January	-0.08	-0.098	-0.94	-1.147
February	0.03	0.033	-0.04	-0.044
March	0.10	0.122	0.11	0.134
April	0.20	0.236	0.69	0.815
May	1.62	1.977	2.15	2.624
June	4.34	5.126	3.58	4.228
July	6.16	7.518	4.70	5.736
August	5.55	6.774	3.83	4.674
September	3.19	3.768	2.26	2.669
October	-0.12	-0.146	-0.16	-0.195
November	-2.48	-2.929	-3.23	-3.815
December	-0.76	-0.928	-2.67	-3.259

* Calculated value (ET_{Idaho} data in mm/day / 25.4 in/mm ***** #days in month)

Since the facility is growing trees instead of a single-season crop such as alfalfa or hay, it was determined to make the IWR growth year specific. The United States Department of Agriculture (USDA) has published Technical Note No. 37, Hybrid Poplar: An Alternative Crop for the Intermountain West which includes ranges of the estimated water use for hybrid poplars based on the growth year (see table below).

Table 8 Estimated Water Use Ranges for Hybrid Poplars by Growth Year

Crop	Estimated water use (inches/acre-year)	Value used for calculation (inches/acre-year)**
Hybrid poplar (1st year)	10-14	12
Hybrid poplar (2nd to 3rd year)	22-26	23/26
Hybrid poplar (4th year to harvest)	32-36	34

*Based on table on page 6 of (USDA, 2001)

**Values are generally the average of the estimated range for each year

Willows have little crop data available, although several studies, including one done by the Danish Environmental Protection Agency (DEPA, 2003), have stated that they are high water users (>20 inches/acre-year). The following estimates of water use by willows were used in calculating the IWR.

Table 9 Estimated Water Use for Willows by Growth Year

Growth Year	Value used for calculation (inches/acre-year)**
1	6
2	12
3	18
4	24

From Table 7, only non-negative values were used for each species to determine the percentages of the total required water to be applied per month for each year of growth. As explained in Section 4.4.1, at the request of the facility a small IWR was calculated to allow the facility to irrigate during the first half of October in dry years using the average rainfall for the region and the P_{def} data from the ET_{Idaho} website. The following tables show the calculation of the monthly irrigation rates for poplars and willows, respectively. Monthly irrigation values were calculated only for the proposed growing season (May 1 to October 15).

Table 10 Calculation of Monthly Irrigation Rates for Hybrid Poplars

Month	P_{def}	Percent of Total P_{def}	1st Year	2nd Year	3rd Year	4th Year
February	0.033	0.13%				
March	0.122	0.47%				
April	0.236	0.90%				
May	1.978	7.54%	0.91	1.73	1.96	2.56
June	5.126	19.54%	2.35	4.49	5.08	6.64
July	7.518	28.66%	3.44	6.59	7.45	9.74
August	6.774	25.82%	3.10	5.94	6.71	8.78
September	3.768	14.36%	1.72	3.30	3.73	4.88
October	0.677	2.58%	0.31	0.59	0.67	0.88
Total	**26.231**		**11.82**	**22.66**	**25.61**	**33.49**

Table 11 Calculation of Monthly Irrigation Rates for Willows

Month	P_{def}	Percent of Total P_{def}	1st Year	2nd Year	3rd Year	4th Year
March	0.134	0.62%				
April	0.815	3.78%				
May	2.624	12.19%	0.73	1.46	2.19	2.92
June	4.228	19.64%	1.18	2.36	3.53	4.71
July	5.736	26.64%	1.60	3.20	4.79	6.39
August	4.674	21.71%	1.30	2.60	3.91	5.21
September	2.669	12.40%	0.74	1.49	2.23	2.97
October	0.652	3.03%	0.18	0.36	0.55	0.73
Total	**21.534**		**5.74**	**11.47**	**17.21**	**22.94**

Dividing each value by 0.85 gives the values in Table 1, which represent the irrigation water requirements for each tree species by growth year at an irrigation efficiency of 85%. The irrigation system is discussed in Sections 4.4.1 and 7.1.